CLAIMS

1. A method for correcting luminance non-uniformity in an image displayed by a projector in response to input image data, the method comprising the steps of:

using a digital camera to capture images generated by the projector at constant input levels, each captured image having a dimmest point;

generating from the captured images a projector correction plane for each of at least some of the input levels, each projector correction plane configured to attenuate input image data to match the dimmest point as captured by the camera for the respective input level; and

modifying input image data to the projector with the generated projector correction planes such that the resulting display image is uniform in luminance.

2. The method of claim 1 further comprising the step of generating a camera attenuation array that flattens the field of the camera.

3. The method of claim 2 wherein the step of generating the camera attenuation array comprises the steps of:

capturing one or more images of a uniformly illuminated two-dimensional ("2-D") plane, the one or more images having a dimmest point;

dividing each point of the captured image into the dimmest point.

4. The method of claim 3 wherein

each captured image has a plurality of pixel values,

the pixel values for each captured image are averaged, and

each pixel value is divided into a dimmest pixel value to produce the 2-D camera attenuation array.

5. The method of claim 4 wherein the 2-D plane whose image is captured by the camera is a white board disposed within a space having homogenous, ambient illumination so that the white board is evenly illuminated relative to the camera.

6. The method of claim 1 wherein the projector has a plurality of projector pixels and the camera has a plurality of camera pixels, and the step of using the camera comprises the steps of:

supplying input data to the projector such that each projector pixel is at a first input level;

capturing the image produced by the projector at the first input level multiple times;

averaging the multiple captured images to produce an average camera captured image plane for the first input level; and

repeating the above steps for each projector input level.

7. The method of claim 6 wherein the step of generating the projector correction planes comprises the steps of:

organizing the averaged camera captured image planes into a camera capture array, each plane associated with a projector input level and having a dimmest camera pixel value;

identifying the dimmest camera pixel value for the camera capture plane associated with a selected projector input level;

in the projector correction plane associated with the selected projector level, setting the pixel that matches the dimmest pixel from the respective averaged camera capture plane to the value of the selected projector input level;

searching the columns associated with each pixel of the averaged camera capture array other than the dimmest pixel for the averaged camera capture plane whose pixel value matches the dimmest pixel value; and

setting the pixel in the projector correction plane to the projector input level associated with the averaged camera capture plane that matches the dimmest pixel value.

8. The method of claim 7 wherein the camera has a camera resolution, the method further comprising the step of subsampling each averaged camera capture plane such that the subsampled planes are smaller than the resolution of the camera.

9. The method of claim 8 wherein the projector correction planes have a size equal to the subsampled averaged camera capture planes.

10. The method of claim 9 wherein the projector has a projector resolution, the method further comprising the step of interpolating each subsampled projector correction plane to match the projector resolution.

11. The method of claim 1 further comprising the steps of converting the projector correction planes into a two-dimensional spatial attenuation array and a one-dimensional gain vector.

12. The method of claim 11 further comprising the steps of:
normalizing each projector correction plane; and
averaging all of the normalized projector correction planes to produce the spatial attenuation array.

13. The method of claim 12 further comprising the steps of:
dividing each projector correction array by the spatial attenuation array; and
averaging each divided projector correction array to produce the gain vector.

14. A projector comprising:
an interface for receiving image data including input levels and corresponding pixel location data;
a luminance non-uniformity correction engine for modifying the input levels received at the interface to be uniform in luminance; and
a light engine for generating a projected images based upon the modified input levels and corresponding pixel location data from the luminance non-uniformity correction engine, wherein
the projector has a dimmest point for each input level, and

the luminance non-uniformity correction engine attenuates the input level data to match the dimmest point.